tornado that hit Vicksburg, and the part played by the Corps as a whole-and specifically the station people—in regard to rescue and cleaning up.

Q: Was there a particular reason why the station people were more involved than any other Corps elements?

A: No, not really. We just divided up the town. After the tornado occurred, I went into town immediately and saw the mayor and offered our assistance.

Q: That was in December, wasn't it?

A: Yes. That night or the next morning, General Hardin got a message from the Chief of Engineers instructing him to take charge of the Corps' activities and to assist the city in any way possible. Just as a matter of control, he and I agreed that the station would be responsible for rescue and cleanup at the theater, and the other office would handle other portions of the task. But we weren't the only ones involved. We probably had more of our own people because the district used contractor personnel as I remember. As I said, our principal area of activity was cleaning up the theater. Incidentally, my son and I were at the theater together that afternoon and left about an hour before the tornado occurred.

Q: Were you familiar with the Humphreys and Abbot report on the Mississippi that was published in 186 l?

A: I was aware of it. However, I was more particularly familiar with the Jadwin Plan because I had gone through the flood of 1927. I was quite familiar in a general way with the aspects of the Jadwin Plan, which really was the plan for developing of increased protection for the lower Mississippi following the 1927 flood. In fact, while I was still in high school, I had worked on some of the levees in Arkansas and Louisiana under the Vicksburg District.

Q: Do you have any feelings about the virtues of the plan?

A: Well, there were levees, but the plan also included some reservoirs on tributaries to control flow. And the plan included a spillway-at least Bonnet Carré at that time. There were also plans for floodways. One of these was never built because the people in Mississippi, who had a stronger voice in Congress, decided that the way to do this was to flood Arkansas, and the people in Arkansas didn't like it. As a result, the Eudora floodway never came into being, partly because of the objections from the area in which I lived. However, levees on the Mississippi side, under that plan, were higher than the Arkansas levees. With this design, if a break or overtopping occurred, it would occur

on the west side of the river instead of the east. There were lots of hard feelings and arguments on that score.

In the original plan, there was also a fuse-plug floodway at New Madrid, Missouri, which was built.

Q: Did the Waterways Experiment Station get involved in any of the discussions about the Atchafalaya River capturing the Mississippi?

A: Oh, yes. In fact, the model studies for the control structure at Old River were all done at the experiment station.

Q: Was that while you were there?

A: Yes, the start of it. I can't remember exactly when the studies were finished.

Another major project during my tour was the development of Niagara Falls for additional power through a better distribution of the remaining water over the falls. We also did a number of harbor studies on portions of the Chesapeake Bay, the Delaware River, Charleston, and Savannah, among those that I remember.

Q: As far as the Atchafalaya is concerned, you said that there was a model constructed. Do you recall anything specific?

A: The question, of course, was how to operate the control structure to divert the flow of water out of the Mississippi while at various levels. Our soils lab also did some studies of the foundation conditions. But this was primarily a design responsibility of the Mississippi River Commission rather than of the experiment station. The model studies basically related to hydraulic aspects of diversion of flow. Where would the structure be set? How would it be aligned? What size gate openings would be needed to divert a given quantity of water safely under controlled conditions?

Q: Are you aware of the continuing discussion of this issue, and do you have any opinions on it?

A: As I understand it, discussion on the subject does continue. My view is that as long as they can hold the control structure, they will prevent total diversion from happening. I know there are some foundation problems regarding the control structure, and I'm not totally up to date as to exactly what these are. It sits on a very deep silt bed.

Q: So they can prevent the Atchafalaya from capturing the Mississippi?

A: Yes. If they can hold the structure, they can prevent it.

Q: And they should?

A: Well, I think we certainly should try. It would be an economic disaster to southern Louisiana if total diversion ever did occur.

Q: Carroll Le Tellier, who later became a general officer, was one of your assistants?

A: He was there on a special assignment dealing with the measurement of airfield pavements for trafficability. This was a special program for the Air Force. We sent teams to all parts of the world where they had air bases, to measure trafficability and load capacity of airfield pavements.

Q: Is that a typical involvement of the Waterways Experiment Station?

A: WES had an outstanding soils and pavement laboratory. This was a part of the activities in support of military construction at the station. The Corps had a separate laboratory in Cincinnati, Ohio, that was a concrete pavement laboratory. But this was the flexible pavement, or asphalt pavement, laboratory.

Q: How would you comment generally on the civilians whom you had working for you?

A: We had an outstanding group of people.

Q: Did you say you knew a lot of them beforehand?

A: No, not too many of the key people. I knew a few, but not the key people. I think it was an outstanding group of people, who became world renowned.

Q: Do you recall who some of them were?

A: Well, yes. The heads of the three major laboratories. Head of hydraulics was [Eugene] Fortson, and Fred [Frederick R.] Brown, who is now the WES technical director, was one of his immediate subordinates. [Joseph B.] Tiffany was the-1 don't remember the title then used-principal civilian during my tour. Willard J. Turnbull would have been the head of the soils group, and he had several people with him: Bill Shockley, I remember. Herbert Cook was head of the concrete laboratory. Really an outstanding group of professional engineers. There's no question about it; they were the experts.

Q: Did you later use some of these people when you were in OCE? I mean bring them into OCE?

A: So far as I know, none of them moved permanently into OCE. Nobody wanted to leave Vicksburg and go to Washington. However, they were certainly available for consultation and were very actively consulted by both the military and civil works people.

Q: The nuclear weapons effects capabilities you mentioned earlier; this was simply to test the effects?

A: As I remember it, it started out as an offshoot of the Bikini atomic tests. The purpose was to see if, through use of models, scale studies of weapons effects could be made based on the information obtained from the Bikini shots. It was a way of using known data to gain additional information.

Q: And that caused a bit of a problem?

A: Well, the explosion tests were being done at the station, and there were many complaints, some from station employees who had houses close by. It looked to me as if the program was likely to expand, so this was the time to do something about putting it on a better footing. We went looking for a better place that was more isolated and came up with what was called the Big Black test site.

Q: What would you rate as the most important function of the Waterways Experiment Station while you were there?

A: I suspect the model studies of various structures being planned, such as dams or other navigation and flood control improvements. Overall, the most money was spent in that area. We were also doing a lot of soils laboratory type work and served as the soils laboratory for the Lower Mississippi Valley Division on more or less a retainer basis. I couldn't name one specific function that was most important.

Q: You worked with the Air Force, too, then, did you not?

A: Primarily in. research on military paving.

Q: Would this have been the first time that you were involved with the Air Force?

A: No, the first time I'd been involved with the Air Force was in connection with construction on Okinawa.

Q: Okinawa, yes. But these were all experiences building to your later CEBMCO [Corps of Engineers Ballistic Missile Construction Office] assignment?

A: Yes, I guess so.

Q: Because certainly there you were dealing with the Air Force again.

A: Yes, and my later assignment to Thule, Greenland, was totally on Air Force construction. However, from WES I went to OCE. I had been scheduled to go to the Army War College in 1955. The same day I got notice that I was selected to be a student, I got a call from the OCE personnel officer, General Rodney Smith, who asked me if I'd seen the list of those to go to the War College. I said, "Yes," and he said, "Well, don't get excited. You're not going." When I asked him why not, he said, "You're going to be the executive to the Chief of Engineers."

Executive to the Chief of Engineers, 1955–1958

I can't prove this, but I have very good evidence that this assignment was because General [Samuel] Sturgis, Chief of Engineers, had attended the 25th anniversary of the station. He was impressed enough by what he saw of the organization that he decided when he needed a new exec that I was to be it. I had had no other personal contact with him. All the evidence certainly indicates that it was the impression he gained on that visit that led to my assignment as his exec—it's the only cause and effect that I can put together. I understood that until that time, the exec at OCE had always been selected based on a personal relationship.

I reported in July 1955, and General Sturgis got sick about six months later if I remember correctly. He was away for a number of months during which General [Charles G.] Holle, the senior deputy, was the acting chief Later, Genera1 Itschner became the chief.

Q: September 1956 is when Sturgis unofficially left, but that wouldn't have accounted for the time when Holle was acting.

A: To complete the discussion of the OCE assignment, it was interesting. It was my first experience in getting acquainted with the senior officers of the Corps based on a close association. There were two deputies and the assistant chiefs, who were all brigadier generals. I was a colonel with about 17 year's service when I arrived in OCE. Never having served in Washington before, I found it a real challenge to be the intermediary with the staff and to be responsible for seeing that the chiefs instructions were carried out. It also, I'm sure, made me known to many of the senior people in the Corps, and undoubtedly this had some effect on following assignments. That's surmise on my part, but at least it was the means by which I got quite well acquainted with all the senior people in the Corps.

Q: And that included Weary [Walter K.] Wilson, who later became Chief of Engineers?

A: That's right. He was one of the deputies at that time. I had known him before, but we were not as closely associated as during this assignment.

Q: And you would work with him again in CEBMCO?

A: He was the chief when I went to CEBMCO in 1960. Actually, he became chief right after I was assigned to CEBMCO.

Q: What was it like to work with Sturgis? Your relationship with him was fairly short.

A: Very short.

Q: How would you describe him as a man and as a boss and as Chief of Engineers?

A: Well, he was an easy person for whom to work because there was never any question about what he wanted. He was very explicit in his instructions, and it was not hard to determine just what he wanted and what he anticipated. It also was a learning experience, being my first assignment in Washington. He was aware of that and was very supportive and helpful.

It was kind of an anomaly to have a colonel in that position; however, I got along very well with the senior people. For one thing, I made sure that I never issued any instructions I had no problem saying that General Sturgis would like to have you do so-and-so, and that was accepted. They had come to know that I wouldn't say it unless it came from. him, and there was never any question but that I was simply carrying out his instructions.

The other part of my job was to coordinate and be sure that papers that went to him were complete and that whoever should have had an input wasn't bypassed.

Another major activity was to correlate and establish a basis for updating what was then called "Engineer Orders and Regulations."We needed a more logical format than the bound book: used up to that time with no provision for any changes or additions.

Q: How was your working relationship with General Itschner?

A: Itschner was much harder to work for because he had a hard time delegating. He was a very intelligent individual who had a tremendous capacity and was inclined to get involved in many, many details. Therefore, it was much more difficult to be sure just what it was that he expected and wanted.

I can remember that it was six months after I started working for him before I heard one word as to whether I was or wasn't doing what he wanted. I assumed I was, lacking any instructions to the contrary. But really, it was about six months before he said this is what he wanted me to do. He operated differently because of his inclination to get himself involved in tremendous detail. I emphasize that he had a tremendous capacity. I don't mean to imply that he let other things go. While Sturgis was content to look at the broad picture and say let's do this, Itschner was much more involved in the preliminary details as well as the final decision.

Q: And he took home tremendous amounts of work, according to General Wilson.

A: Yes. I think you'll also find Wilson felt that Itschner was very hard to work for.

Q: One thing that General Wilson said about that period when he was in military construction—1956 to 1960, while General Itschner was chief-was that he felt that General Itschner favored the civil side of the Corps over the military side. General Wilson saw himself as trying to protect "the military side" from this partiality that General Itschner had as chief Maybe you would have a comment on this, too, both because you 'were the exec at this time and because later you were in charge of military construction.

A: I don't think there's any doubt but what Itschner, having moved from head of civil works to be chief-although there was a short period when he was deputy-definitely was much more at ease with and had a much closer relationship with the civil side. It would be hard for me to say that he ignored the military side. On the other hand, I don't have any problem at all seeing what General Wilson was talking about. It was also true that the military side always had somebody else looking at it in the Pentagon. On the civil works side, whatever went out of the chiefsoffice was the final answer. This was true at that, time, but is not any longer. I think both his background and his final authority for civil works led him to give a lot more of his time to the civil side than to the military.

Q: Do you recall Joe Tofani?

A: Yes.

Q: We've been interviewing him about his career. How closely did you work with him?

A: He was in civil works as chief of planning. I knew Joe Tofani well. I had more contact with him after I left OCE than while there. He was in the same job while I was the division engineer of the Southwestern Division, and I would come back to give testimony for annual budget hearings. I also knew him through my service on the Board

of Engineers for Rivers and Harbors. My association was not direct. He never worked for me nor I for him.

Q: I don't think we talked about any specific projects that were important Corps of Engineers projects when you were there in 1955 to 1958 as executive to the chief What was your involvement in construction in Morocco and Korea and with some of the major civil works projects?

A: In terms of policy, I was not deeply involved. But, of course, I was aware of the projects. Responsibilities were pretty clearly defined for the appropriate assistant chief of military construction or civil works. Other than being aware of the projects, possibly passing information to the chief or indicating his desires to the appropriate people, I was not directly involved. This was more of an administrative job and that of coordinator rather than policy maker. There were a number of key events at that time, such as the hurricane in the Northeast and the resulting Project Noah that involved OCE quite materially.

Q: That was soon after you got there, wasn't it?

A: Yes. But again, that position was more one of being responsible for things being coordinated and keeping the chief informed rather than making policy. Such things as arranging for the division engineer conferences were a part of the administrative responsibilities; also, a general supervision of the administrative support for the chiefs office. I provided some coordination with the remainder and other elements of the Army staff-I could not cite a major scientific event for which I could say I personally had major responsibility. There were others more directly responsible.

Q: Did you find the structure conducive to getting the job done?

A: I think it worked fairly well. There seemed to be fairly well-defined responsibilities. There were: some questions about the two-deputy system in relation to the responsibilities.of the chief and the chiefs office at that time. My analysis was that the structure worked relatively well. When the supply mission was removed from the chiefs office and some other activities were no longer there, then I think the decision to move to a single deputy was a move in the right direction.

Q: And you later were deputy chief.

A: Yes.

Q: We talked yesterday about the differences between working for General Sturgis and for General Itschner. Did you have any problems with them, or did you find yourself being a spokesman for them to other people within OCE or the districts and divisions?

A: Not so far as I remember. As I think I indicated yesterday, I had no particular difficulties expressing to others in the chiefs office the chiefs desires or interpreting those desires when asked. And so far as I know, in presenting the positions of others to him, things seemed to work out fairly well. If there were problems, they were not sufficiently severe for either the chief or one of the senior people in the office to make an issue of them.

It was a relatively quiet time. I received major benefits from it being my first assignment to Washington and also my first assignment to OCE. It provided the opportunity, first, to get well acquainted with the senior people in the Corps and, second, it gave me an overview of just how the Corps of Engineers operated in both Washington and at field levels. It was a good training assignment for later activities. I got to see the worldwide responsibilities of the Corps.

Q: How about relations with the Air Force in that period? Later on, you'll have a great deal more contact when you're in Southwestern Division, with CEBMCO, and then back in OCE again.

A: There were no particular problem areas with the Air Force that I remember. A little later, questions were raised as to responsibilities and just what the Air Force would do on their own and what the Corps would do for them. It so happened that my next assignment, after OCE and a year at the Industrial College, was to East Ocean District as area engineer, Greenland. This was basically supervising construction for the Air Force on the Ballistic Missile Early Warning System and its support in Greenland. There were a few questions raised in regard to coordination with the Air Force but nothing of significance.

I think most of the strong discussions came up later and had to do with the ballistic missile work, which was after Greenland. 1 do recall that General Sturgis arranged with the chief of yards and docks of the Navy to establish liaison, which had not been done heretofore. I served as his representative to the Navy concerning mutual problems.

Q: Do you know the motivation for this?

A: I don't think there was anything major that caused this-just the idea of having a point of contact for things that might be of mutual interest. This was not a major activity, but it established a system by which the two offices could keep in touch.

Q: You spent an interim year at the Industrial College of the Armed Forces, so you stayed in Washington. What kind of experience was that in terms of preparing you for later assignments? Was this a common assignment?

A: Well, as I indicated before, in 1955 I was slated to go to the Army War College, which might be considered a more usual assignment. That was deferred by my assignment to OCE as exec. My assignment to the Industrial College, in effect, was an alternative to going to the War College. Generally speaking, in theory at least, the National War College, the Industrial College, and the Army War College were considered to be basically on about the same level and were designed for about the same time in service. Considering the fact that I was in Washington, and therefore didn't have to move to go to school, there was an advantage in going to school in the Washington area. If I had been completely free to choose, I might have chosen the National War College as an alternative to the Industrial College.

Q: Was there any particular reason why?

A: My interests had been more in operations than in logistics.

Industrial College of the Armed Forces (ICAF), 1958–1959

Q: Was there a reason why you were chosen for ICAF?

A: As far as I know, the selections were by a board, and they had their own reasons. I was not particularly unhappy about it, and I think it was a useful year. One of the things I remember is that it was the first time in years that I was responsible only for myself From that standpoint it was a refreshing interlude that gave me time to think and consider things other than organizational and administrative responsibilities, which had been fairly constant over a long period, certainly including World War II.

Q: And that's an important part of an officer's development?

A: I think it is important to be able to get away and stand back and look. So, all in all, I was very pleased with the assignment and the opportunity to get to know a number of officers not only within the Army but from other services as well.

Q: Did you go to the Command and General Staff College?

A: I had not gone to a regular course at Command and General Staff College. In February 1942 I went to a short course there called the Seventh General Staff Class. After the war, that course and my wartime staff experience were considered to be equivalent to

the Command General Staff College course, so I -was given credit without ever attending.

Q: I think in our interview in April I asked you if you encountered any problems not being a West Point graduate. Your assessment, I believe, was that you had expected that as a possibility but you had not found it so. Did this continue to hold true?

A: I think I said then-I'll say now, anyway-as far as I'm concerned it didn't make any difference. I never ran into any problem.

Thule, Greenland, 1959-1960

Q: What was behind your assignment toThule, Greenland? Why were you selected, and how did you feel about this assignment?

A: I don't know what was behind it other than the fact that there was a job to do there. It was a key job for the Air Force and one that the chief and General Wilson, who was the deputy at the time, felt very strongly needed to be done. I was apparently a candidate for overseas assignment at about that time. Why I, specifically, was chosen, I don't know. I do know that I complained a little bit about it. Having had the experience of 21 years of service, I thought I was a little bit senior to be taking an assignment as an area engineer.

However, other than my experience at the Waterways Experiment Station, I had not been directly involved in construction, either military or civil. I assume that had something to do with the decision. In retrospect, I still feel that I was a little senior for the assignment, but it was a good experience. I think we were quite successful in executing the program under some tremendous environmental handicaps. The combination of the darkness and cold and long supply line made it an extremely difficult operation.

Q: About how many people did you have working for you?

A: The contractor was a partnership with Peter Kewit as the principal. The architect-engineer was Metcalf and Eddy, who did some on-site inspection working for the area engineer's office, which had about ten people. It was a very cooperative group that worked very well. As far as numbers of people, my memory is that the contractor employed about 2,000 craftsmen at peak strength.

As I have said in the past, on the 2d of January **1960, we** were very actively engaged at the peak of activity. It was minus 40 degrees, dark 24 hours a day, and we still had

2,000 construction workers on the site. This is a fairly remarkable achievement, I think, in terms of productive work. We were able to overcome most of the environmental difficulties and do a reasonably satisfactory job.

The job actually resulted in a decrease in original contract cost after it was completed. It was an incentive-type contract and was completed not only within budget but at a reduced cost, for which I give the contractor a very large amount of the credit. He had it well organized and had some good people on the job.

Q: At what stage was that program when you went there? Was it at the very beginning?

A: The construction had started with some foundations in, but the major work of erecting the buildings and their interiors, setting equipment in place for the Air Force contractors (RCA and GE for the radar equipment), and erecting the radar towers all took place during that year.

Corps of Engineers Ballistic Missile Construction Office, 19604962

Q: And from there you went to an assignment with the Ballistic Missile Construction Office, which would be at that point in Los Angeles District?

A: I returned from Greenland in July 1960 assigned to command an engineer group at Fort Belvoir. This was in line with normal career patterns since I had not had troop command since World War II. About the time that I returned-I'd been back about 10 days and was on leave-a decision was made by the Secretary of Defense, over the Air Force's objection, that the Corps would be responsible for the construction contracts for the ballistic missile program. We had had a small liaison office working with the Air Force in the Los Angeles area up to that time, and a decision was made to enlarge that office. The new office was to have the direct responsibility for construction rather than having the construction responsibilities spread over existing districts. This had been the case in the Atlas F program, which was the only one under way at the time. That decision required assigning several officers as program directors for the various missile programs, and I was one of the four selected and was assigned to the Titan II program. Actually, I knew nothing about this as it was developing.

Having returned from Greenland, I'd done some work around the house, and we were getting ready to go on a vacation when I got a call Saturday morning that the chief wanted to see: me. I happened to be in the barber shop at the time. But my wife got in touch with me, and I went by the office late Saturday morning. I was told what was happening, and on Monday I was in Los Angeles. I did not get to complete my leave

nor make any provision for moving my family. That indicates the speed with which the organization was established and began to operate.

Q: What was the reaction to this new assignment? Was it welcomed?

A: Well, I'm sure that there were people who felt that no special organization should be established for this program. However, it was a very large program and required working very closely with the Air Force, which was responsible for supervising the design as well as the follow-on weapons placement. This necessary close contact with the Air Force, in my mind, made it an appropriate decision.

Certainly, if there was unhappiness, it didn't really show. The organization for CEBMCO was essentially staffed with people from the Corps as a whole; I don't know of any other organization or any other means by which such a quick response could have taken place. As I remember the figures, there were 50 or 60 people in the liaison office when it became an operating element under Al Welling. Tom Hayes was his deputy; Hayes having been the head of the liaison office. Colonel [Carlin H.] Whitesell was to be the Titan I director, I had the responsibility for Titan II, [Charles C.] Noble had the Minuteman assignment, and "Woody" Wilson was in charge of completion of the Atlas F program. We established the office and within 30 days we were actually in operation. Within six months, I guess there were a total 1,500 Corps people spread out across the country at the various missile sites, with work actually under way. I think it was a tremendous accomplishment. One of the things that made it possible was the fact that we had Corpswide standard contract procedures and methods of operation so that we could gather people together from a large number of Corps offices and they could "hit the ground running." We didn't have to establish a lot of new procedures in order to "go."

The Titan I and the Atlas F projects were both under way, and they were taken over as they were proceeding. Titan II had not started, and Minuteman was a little bit further behind. For the Titan II program, we established the office early in August and let the first contracts for field work in early October. We continued to build the program very rapidly and established field offices in Little Rock, Arkansas; Wichita, Kansas; and Tucson, Arizona; appropriately manned with both military and civilian personnel as required. My view is that the responsiveness of the Corps and the availability of uniform procedures for operating, including contract administration and construction supervision, were outstanding assets in making a successful program possible.

Q: Is that why the Secretary of Defense made this decision? Do you have any insight into that decision?

A: I wouldn't comment. I was not a part of it. I think people like General Wilson and General Itschner are better able to give details than I am since they were actively involved.

Q: What was particularly distinctive about the Titan II part of the project as opposed to the other systems?

A: The Titan II was the first of the ballistic missiles that was to actually fire from the silo. The Atlas and the Titan I, which were both large, long-range missiles, were built with the idea of being raised to the surface on an elevator system before they were fired.

The Titan II was a missile fired from its storage location, and the silo became a gun barrel. There were major problems in terms of structural capability to withstand the firing forces, as well as differences in the fuel system.

It was the first of the missiles to use fuels that were not cryogenic-in other words, not super-cooled. Therefore, it was a different system. The main difference was the close integration of the silo as a firing tube, which added to the problems of close tolerances during construction of the silo.

Q: Did you have to do a lot of self-education on the system and how it worked?

A: Yes, though, as I say, the Air Force through its parallel office was responsible for the supervising of design. The biggest problem was close coordination with the corresponding project officer in the Air Force who had responsibility for design. We were co-located, and we worked together very closely.

One of the most significant aspects, I think, was the decision to do the construction in phases. This later became known as "fast track." We did separate the contracts so that the first major contract was for the excavation and structural concrete. The planned interface for later work was the interior of the main silo concrete. The internals, including mechanical and electric work, would be added by second and third contracts since design was not complete at that time. While there were numerous changes involved, this contract separation, in general, worked well and probably saved 6 to 12 months in completing the construction of the system.

Q: What was the origin of this idea?

A: It basically was worked out jointly by the Air Force and the Corps. Of course, the key to it was having the designer, which happened to be the Parsons Company, design an interface with flexibility in the final work, which allowed the contracts to be separated.

The follow-on contracts were largely electrical and mechanical, with the initial contract largely for civil and structural work.

Q: How easy were the Air Force representatives to work with?

A: Well, they varied, but basically, while we didn't always agree on everything, I would say the coordination and cooperation were excellent. The fact is, I still have close friends among the Air Force people whom I met at that time. Any animosity caused by the secretary's decision for the Corps to supervise construction certainly didn't interfere with getting the work done. Both at the headquarters and in the field there was a great deal of very close cooperation required and given.

Q: What about, the liquidated damages provisions?

A: I'm sure there were some liquidated damages. The fact is the contracts were very closely drawn, with milestone dates and other requirements. But without reviewing the contracts I couldn't specifically comment. In my opinion, on Air Force insistence, we put some unreasonable dates in the contracts. They felt these would be an added incentive to the contractor to meet his schedule. I'm convinced that in some cases these deadlines were counterproductive, but this was one of the areas in which there was a good deal of disagreement. These were attempts to put into the contracts very critical and short dates through a series of milestones as measures of contractual performance. While I remember that dates were not easy to meet, I don't remember major difficulties in terms of liquidated damages.

Q: I found in our office records a transcript of an interview. I'm not sure whether it actually was an interview. I think it was more in the form of comments that you made about CEBMCO after you'd gotten to Dallas. You said that one of the biggest sources of difficulty at CEBMCO was the fact that the Air Force was over committed so that fund availability was a constant concern. Would you like to comment on that?

A: Well, I don't think I have anything to add to that. They were trying to run a tremendous program with four major systems at the same time. Certainly, funding to meet a rigid schedule was a problem, also their feeling that they wanted to be certain that we didn't pay more than necessary and that we got strong competition for the contracts. There is nothing wrong with that, but some of the deadlines they insisted on mitigated against the best actual bids. There was always a question ofjudgment as to how and when to structure the bids. Certainly, the more restraints and milestones and other requirements put in, the more contractors would be inclined to add contingencies.

So things, as I say, did not always work together, but again, these were problems of the moment. I think one of the most significant decisions we made-and this was made by

CEBMCO as a whole, not directly by me, although I was a part of it-was to go into a system of prequalified contractors, which had never been done in government contracting.

With the help of the chiefs office and particularly the legal people there, a procedure was developed to prequalify contractors so that we knew that those who were invited to bid on each contract had the capability to do the work required. This included considering type of work, size of contract, and both the financial and management capability. In my judgment this, as much as any other one thing, was responsible for the success of the program. When I went to Dallas and had the responsibility of building the Manned Spacecraft Center at Houston, under the supervision of the Fort Worth District, I instituted the same system of prequalified contractors for that program. Again, I think, with very good results.

Q: This "fast-track" system that you mentioned, is that at all related to the critical path method?

A: Critical path is not a method. Critical path is really a planning schedule means by which you break a project down into a large number of individual action items. As a result, you can follow the project very closely in terms of where you stand at any given time.

Q: It's a monitoring device?

A: It's more a planning and monitoring device.

Q: Using a computer?

A: If available, you can use a computer. Originally, it was done by hand. It still can be done that way.

Q: Was that instituted while you were at CEBMCO?

A: We used it on some of our contracts, and the Air Force had an overall project system using essentially critical path schedules. This basically had come out of the Polaris program of the Navy, as I remember.

Q: Did you carry that with you to Dallas?

A: Partially, I did. I set up a major study of the Arkansas River program that was essentially based on critical path scheduling.

Q: What would you say about the experience-you used a number of junior officers, of course, at the resident area offices. What do you think about the experience that they gained there'? Was that a critical factor for them in later assignments? Did you see individuals who had had those positions being used later on when you were in Dallas and OCE?

A: I think that the use of junior officers in this job served several purposes. One: for the most part these officers were graduate engineers who had technical expertise available on the site. They had had some experience in management and, when backed up with qualified inspectors from Corps districts, made a good on-site supervisory organization. Again, the combination of military and civilian employees, as has been routine throughout the Corps, worked very well.

I would say that those individual officers got tremendous experience out of this assignment. Many of them went on to be district engineers and to other assignments where this early experience in the field, I'm sure, was extremely useful to them. But initially this was probably a secondary consideration; the idea was to get qualified people quickly, and we used both civilian and military assets to set up these offices.

Q: You said that under these circumstances, this separate operating organization was preferable to the standard district and division organization. In what other cases do you think such an organization is merited? What is it about a particular program that warrants a separate organization?

A: In the first place, I wouldn't say that this is always the right answer. I simply said that in my opinion, this case represented a peculiar combination of the Air Force requirements—it was already well under way in design, a very large program, and widely distributed—and it justified setting up a special office to do the construction.

This was done again at the time of the establishment of the antiballistic missile system, which, though it started as a fairly broad operation, never exceeded two sites being worked at any one time. The NASA program, which was fairly widely dispersed, was established with a coordinating office in the chiefs office with the work accomplished by the individual districts and divisions. The NASA program was not under the same pressure gradient, did not use the same design for multiple locations, and was not such that it needed to have a superimposed special organization.

I think that each case is usually different. The main thing to consider is the flexibility and the availability of the Corps to operate, either through the existing organization or by making changes as necessary in that organization, and to meet a specific requirement and mission. The strength lies in the qualifications of the people who are available regardless of the management chain through which they operate.

Q: When you encountered the problems that you did encounter working with a separate organization that was, like the Air Force, so involved in design-and I mean problems basically of funding and contractual arrangements-did the Corps try to influence a change through the Department of Defense? Did they think that certain methods and procedures were better than others?

A: We were required to follow procurement regulations. I would say that where I, as the director of the Titan II program, felt strongly that a particular type of contracting wasn't the desired method, I got support both through CEBMCO and the chiefs office for my position. I don't remember any major disagreements. I felt I was supported all the way through on those things which I wanted to establish.

For instance, I set up procedures for government procurement for about 30 major equipment systems. This procedure was to insure uniformity with each missile silo complex for all major equipment as well as to control delivery of these items. They were bought under materials supply contracts I negotiated rather than having contractors supply materials. These included things like the standby power system, the mechanism for door operations, other pieces of equipment such as pumps, and other items that we wanted to standardize for all of the 50-odd silos. I didn't have any difficulty in setting it up. Actually, I used different Corps offices as procurement offices. For instance, I remember the Kansas City District did a lot of this procurement.

Q: Was that an arrangement for having the office nearest the successful bidder as the procurer?

A: No, we selected the office based on where we thought bidders were likely to be. They were used to handle supply contracts. While we had people in CEBMCO who were qualified in construction contracts, we weren't as used to handling supply contracts. We also used the existing Corps system for in-factory inspection and expediting.

There was another thing that I did that I think was very useful. I made it a point to visit the manufacturer of each critical item or piece of equipment sometime within the first few months after the contract was signed. The purpose was to personally impress on the manufacturer's key people the importance of what they were doing for the overall project.

This also gave me a personal contact at each of these plants so that later, if there were any difficulties in deliveries, I could take direct action. I'm firmly convinced this was well worth the effort to see for myself and to be seen and be able to talk to the people and impress on them the necessity for meeting their commitments for delivery of these critical items.

Q: Did you have to go to the area offices under your program frequently?

A: I made it a point to visit each area office at least once a month.

Q: Where were they located?

A: Tucson, Little Rock, and Wichita, and, indirectly, Vandenberg Air Force Base, where three silos were being built by the Los Angeles District under its responsibility for all work at Vandenberg. Over the period from August 1960 until I left the program in February 1962, almost without exception, I visited every area office at least once a month and saw most of the individual work sites on each of those visits.

Q: Your deputy was Robert McKenzie?

A: Yes.

Q: And he was a civilian?

A: He was a civilian employee who came from the Los Angeles District with considerable experience i:n both military and civil construction. He was an old-timer, well qualified, and a tremendous help in overseeing the day-to-day operations of the project office during my extended travel. He was the anchor, the fellow who stayed most of the time at the office to keep things running on a day-to-day basis. He did an outstanding job.

Q: I wonder if you would comment on some of the other individuals involved, such as the other project directors-Noble and Whitesell as well as Hayes and Welling-their suitability to these assignments and experiences that you had with them.

A: Basically, while I won't comment much on individuals, as I have said, I think the organizational idea was a good one. I think, too, that a good job was done in selecting people to hold the key offices. With the decision to place a general officer as the head of CEBMCO, Welling, who'd had considerable experience and who knew the Corps well, was a good choice. He had served, among other jobs, as exec to the chief. His background in dealing with the Corps and his experience in dealing with the Air Force shortly after World War II helped. I think he was an excellent choice to hold his own in a very strong Air Force environment. As a manager, he had his idiosyncrasies, and these made him not always an easy person to work for or deal with. But, under the circumstances, he was a good choice for the job.

Tom Hayes was a very practical, technically well-qualified individual. And I suspect, though we have never talked about it, that his experiences as deputy to Welling may

have left scars. Nevertheless, I think he did a very fine job of being the alter ego in the headquarters.

As to the individual directors for various systems (there was a change in one after the initial selection), I believe that events proved that the selections were wise of the four who have been named-Whitesell, Noble, Wilson, and I. I personally had known all of the officers involved, some a little better than others. I'd actually worked for Whitesell during my service in Greenland since he was the district engineer, East Ocean District. Noble and I had served together as lieutenants on the Mexican border.

Q: That goes back a ways.

A: Back to about 1940. Wilson I had not known as well, but I knew of him. So I feel the combination of both people and organization was a good one, as the results proved.

Q: Do you have any other comments you'd like to make about that experience before we talk about the Southwestern Division?

A: I don't think so.

Southwestern Division, Dallas, Texas, 1962-1964

Q: When you got the assignment to Southwestern Division (at that point, too, you would become brigadier general), you had not had a district assignment as such. Was this unusual? Of course, you did have your Waterways Experiment Station experience, and, as you mentioned earlier, while this wasn't really a construction job, it was a civil job and you had OCE experience. How did you feel about getting this assignment?

A: Well, obviously I was glad to have it. Basically, my assignment from CEBMCO ended a little earlier than it normally would. In other words, I was promoted out of the job. We were well along in the Titan II program but it had another year or so before completion; however, it was well on track with an existing organization moving ahead. So, with my selection for promotion, a reassignment became necessary.

I was told of this by the chief General Wilson, and I was delighted at the idea of going to Dallas. Since Arkansas was my home and one of the districts was the Little Rock District, I had some knowledge of the division's activities.

As far as preparation for the job, I think the combination of experience as director of the Waterways Experiment Station, exec in OCE, and actual field experience in Greenland along with being the director of the Titan II program probably gave me as

much or more experience in actual construction and its supervision as anyone who might have gone into the position. From that point of view, there was no particular worry; I felt I had the background to do the job.

I think the experience at the experiment station in managing what was essentially a civilian organization, as the experiment station was at that time, gave me the opportunity to be well acquainted with the Corps' method of operation. From my experience in OCE, I was also familiar with both the military and civilian side of the Corps and the system of planning civil works projects.

Certainly, I'd had good experience in dealing with the Air Force, and we would be responsible for its construction in that area. My feeling was that it was not a particularly traumatic new experience but simply a move into a broader level of responsibility for which the assignments of the last few years had pretty well prepared me.

Q: One of your major projects there was to provide NASA support and to help direct the Johnson Space Center construction at Houston. Did the Corps get these projects because of its experience? Of course, it already had some NASA work under way at that point.

A: Again, I think General Wilson is probably the best qualified to answer this question in detail. My understanding is that with the formation of NASA as a new organization, Mr. Webb, who had been head of OMB [Office of Management and Budget], was designated as the administrator.

He, realizing the task of beginning a space program while trying to put together the facilities needed to support it, looked around to see whom he could call on to assist him. From his experience in OMB, he was aware of the Corps' countrywide operation. My understanding is that he entered into an agreement with General Wilson for the Corps to be the construction agent for NASA with assignment to the appropriate division of the facilities that were in that division's area-South Atlantic for Cape Canaveral and Huntsville, Southwestern for the Houston center, and South Pacific for activities on the West Coast.

A coordinating office was established in OCE with General Hayes designated to be in charge and to work with NASA headquarters. While it was a unique system, what we built at Houston was, in effect, a technical college campus on what had been a cattle ranch. When I arrived in Dallas and made my first visit to Houston, they had just started digging a few trenches to put in utilities in an open field. This then became the Manned Spacecraft Center for coordination, control, and training of the astronauts for the manned space program.

The Fort Worth District, at that time under Colonel Frank Koisch, was assigned the responsibility for supervising design and construction. The district carried out the mission well. I gave it a considerable amount of personal attention, visiting the site at least once a month or every six weeks and maintaining close coordination with the NASA people in Houston.

Q: Do you recall major difficulties at that time?

A: I would say the major difficulty was in getting decisions from the NASA people. As a new organization, they had no established procedures. Each element of the organization would put in its ideas of what it wanted, and it was our job to come up with a complete design to carry the construction forward. Lacking any criteria, there was a wide variance in what various people desired.

So, one of our biggest problems was coordinating the desires with reality and establishing for the various facilities some general criteria that we felt were not totally foreign to other government activities. We, in effect, developed space and other criteria based on the experience of the Corps, GSA, and other agencies. We "sold" these to NASA to provide appropriate controls so that facilities wouldn't be "gold-plated," as they might otherwise have been if left to the individual desires of the people involved.

One of the real significant factors was that this work was going on while the NASA people were operating an ongoing program' and starting the Mercury and Gemini programs. We had to catch them when they were not otherwise engaged. I would say getting a firm handle on the requirements and the criteria to meet those requirements was the biggest single problem, and then, as always, the funding availability was a matter of concern.

Q: I think one of the issues there was cost estimates at the outset of construction. I believe you indicated you thought this was the best approach but it was not part of NASA's approach.

A: Again, I think this goes back to the criteria. You can't make a good estimate if you don't know what you're going to build or to what standard. We had a constant battle getting firm decisions on which we could make good estimates. Until we finally reached a good understanding of what those criteria would be, it was always a problem trying to forecast the cost.

One major item of discussion that reached high political circles was the exterior finish of the buildings at the space center. We had decided that it would be precast exposed aggregate panels. There was a great deal of political pressure from the masonry industry and brick layers' union to convert to brick masonry construction. We had to

make several studies to convince the people in Washington that we weren't adding to the cost by our decision.

In this case, brick construction, we found, would be more expensive and take longer. One of the reasons why I very strongly favored the tilt-up type, precast panels, was the ease with which we could enclose a building once we put up the steel framework. In the Houston area, which had a considerable amount of rain, this was very important. Architecturally, the effect was also a pleasing one.

Q: What was the reason for wanting the brick?

A: Purely political. Pressure from the masons' union and the association of masonry products.

Q: Did you find a great deal of pressure from President [Lyndon] Johnson when you were in Southwestern District?

A: Personally, no. Certainly the White House got into this brick question, and he was definitely instrumental in selecting Houston as the location of the Manned Spacecraft Center, but that decision had been made before I arrived.

Q: Did you think that was the best location?

A: I think it was as good as any. I don't think it would have been possible to say that any one location was better than all others. I think the decision to spread the program across the country was proper, Certainly the community in Houston with the nearby schools and other technical centers made it a good choice. No question in my mind, the choice was political; but I don't know of any reason why another site would have been better. It was fairly centrally located in the country with good transportation and in a mild climate, all of which were desirable.

Q: I believe that General [Daniel A.] Raymond in an interview said that he was in Mobile with some NASA construction responsibility. And that, as he recalled, the first time he really got to know you was in consulting over the NASA programs and similar problems that you both might be having. Do you recall this kind of coordination?

A: Yes, I actually visited them. He had responsibility for the Huntsville program, which had firing stands and things of that sort for actual test firing of some of the propulsion systems. He dealt with a very strong individual, Wernher von Braun, who had his own ideas because he was more or less the father of the space system. I did, as you say, talk to Raymond and others in Mobile about some of their activities.

There were also other activities in the civil works programs. I remember at least one or two visits there in connection with that program. But again, the overallcoordination for NASA was handled by Hayes in Washington. We used to have meetings atvarious places-the Cape, Huntsville, and other places where those of us involved in the program could discuss mutual problems and coordination. My memory is that these were primarily sponsored by Hayes and were very useful in helping us in our approach to similar problems. I think there was better coordination within the Corps on these activities than there was within NASA because it was a new organization of individual fiefdoms that were not as closely connected and coordinated.

Q: Were there other important military projects you had?

A: There were a number of military projects in the Albuquerque District. They were primarily for the Air Force, but some were for the Army. There was other military construction for the Air Force in the Fort Worth area-at Carswell Air Force Base and other bases in Texas and Oklahoma. There was a considerable amount of work for the Army, particularly at Fort Hood, Fort Sill, and Fort Bliss, but no large or overly significant individual projects such as the Manned Spacecraft Center for NASA.

The single most important civil works project was the start of the construction work on the Arkansas River navigation project. In terms of individual projects, the NASA project and the Arkansas River project were the two major activities, although we had a fairly large civil program not connected with the Arkansas program. Work on a number of individual dams in Texas, one or two in New Mexico, several in Oklahoma, and flood control in San Antonio and Houston, I remember, were all going on at this time. Again, the major civil activity was the initiation of actual construction on the system of locks and dams for Arkansas River navigation.

Q: You mentioned, in regard to the Arkansas River, instituting critical path scheduling there. Would you like to say more about that?

A: I guess that was more self-preservation than anything else. General [Robert] Fleming, who preceded me as division engineer, in planning the Arkansas River project, had indicated his feeling that the project could be completed by-1 can't remember whether it was 1968, 1969, or 1970. Do you have the figure?

Q: I don't have that right here.

A: We'll have to check this. But he had made a general commitment to the congressional delegation, principally Senator [Robert H.] Kerr and Senator [John L.] McClellan, that he thought the project could be completed by a specific date. If memory serves me, it was 1970.

Opening bids for the first lock and dam of rhe Arkansas River Project, October 1962. Col. Charles Maynard, Little Rock District Engineer, second from left stands beside Brig. Gen. Carroll Dunn, Southwest Division Engineer, and Lt. Gen. Walter K. Wilson, Chief of Engineers .

Within a few weeks after I arrived there, I attended a meeting of the Arkansas River Basin Development Association in Tulsa. At that meeting I met Senator Kerr and Senator McClellan for the first time. Senator Kerr turned to me and said, "Well, young man we're glad to see you here. We're glad to have a native of Arkansas available and interested in this project. Your predecessor indicated that this could be completed by 1970. If you can complete this more quickly, I promise you that you can be governor of Arkansas or Oklahoma, either one that you'd like."

I responded to the senator that my problem was not the desire to be governor of either state-although I was an admirer of both-but that my real problem was determining not whether the schedule could be beaten, but whether it actually could be accomplished as General Fleming had outlined. My first effort would be to determine what we could do to hold to his schedule.

With that background I decided to do an overall planning study of the total project and instigated it through the division office. We let a contract to a Texas Instruments subsidiary to make a detailed study and develop a detailed critical path schedule of all activities in connection with the project, including land procurement, bridge and road relocations, design, completion of planning, as well as construction schedule. As I remember, we had some 5,000 events that were involved in putting this all together. As a result, we were better able to correlate the schedules for the various project segments.

One result was the elimination of one or two of the original proposed dam structures. We were able to determine that, by a small change in land acquisition and reservoir level at several of the dams, we could eliminate, as I remember it, two dams in the 432. mile channel. We put this all together in one plan and followed up with a detailed listing of annual funding requirements to go along with this schedule.

By the time we finished this study, we had a very good outline plan as to what could be started when, what its schedule for design and construction had to be, and what the funding requirements were year by year for the entire project. Based onthis? we could forecast our funding requirements in the annual Corps' civil works budget.

After I left Dallas, these continued to be the schedule and funding requirements. The project was completed with navigation available to Little Rock in 1968, to Fort Smith in 1969, and to the head of navigation in 1970 as planned. And we were within the budget figure of $1.2 billion. This was the original forecast for the cost of the project. I believe it was actually completed with something like $100 million under the original estimate and within the 1962 time schedule.

As I viewed it then and as it continued after I left in 1964, this planning, done eight years before the project was completed, was a tremendous advantage to the program. I had questions, both while I was there and later, as to whether or not the budgeted amount of money was required. In several years it amounted to over $100 million, which, in terms of the total civil works budget, was an appreciable figure in those days. The question was whether that figure could be reduced. My answer always was, "Yes, we can reduce it to whatever you want, but we can't maintain the schedule if we reduce it."

So having this detailed plan meant that there was a firm commitment to a schedule and to the funding required to meet that schedule. As far as I know, certainly as long as I was there, the funding was available. Because the project was completed on schedule, I assume it continued to be funded as forecast. I think this type of planning was very helpful for that project.

Whether or not it would be a good idea to have such a schedule for every Corps' project is a matter of policy because there are many political factors involved. In any administration as well as in the Congress, there are always questions as to where the money available for civil works funding is going to be allocated. Having one project that, in effect, gets priority sometimes affects the distribution of funding to other projects.

I suspect there was less than enthusiastic acceptance in some quarters of the fact that we had put a strong claim on a given amount of money for any one year. That meant this project had to be taken care of and other projects might not receive the funding that other people might have desired. But for that particular project, I think it was an excellent idea. It proved to be both accurate in its forecast of time and cost and also gave us the opportunity to plan realistically and to complete it over the eight-year time frame.

Q: Are you aware of other instances where this was used then or later?

A: I'm not aware of any. It may have been used in the Tennessee-Tombigbee project, but I don't know.

Q: And you thought that method may have been from Polaris?

A: It originally came out of the Navy's Polaris program.

Q: And you became aware of it at CEBMCO?

A: Yes.

Q: How did you feel after this initial meeting with Senator Kerr when he offered you the governorships of two states? You already had some strong political figures in Texas that you had to deal with like Johnson and [John] Connally and others.

A: I was aware of political reality, of course, from my service in Washington. But I realized that I had to have something more than guesswork to use in talking to these people. I had to have factual information that I could rely on in dealing with them, because the pressure was always, to "get it done." Of course, Senator Kerr didn't live a year after that time, but Arkansas Senator McClellan picked up the ball and continued the close Senate interest in the program. It was essential to have factual basis for commitments as to what could be done.

Q: What would you see as the most challenging aspect of the Arkansas River system?

A: Well, I think the most challenging part of it, other than the scope and complexity, was the problem of dealing with a heavily silt-laden river. We were trying to develop and maintain the channel without excessive dredging. I had a number of studies done—model studies at WES at Vicksburg-for each of the major structures to be sure that the alignment of the channel was the best we could devise.

We looked at the effect of the major dams upstream, such as Keystone and Eufaula in Oklahoma, to see how much silt they would remove in their impoundments of water. Technically, the biggest question really was how to establish and maintain the navigation channel. We had a 9-foot authorized depth of channel. I had the design made so that the sills of the lock were set at 12 feet. This meant that if ever there was a need to deepen the channel, the locks would have already been established so that they could provide a 12-foot channel without major revision.

Q: I wanted to ask you about the Trinity River project. In 1962, when you first got to the Southwestern Division, a study of the whole project that had been started in 1958 was completed. I guess it was subjected to congressional review. One thing that the committees in Congress objected to was the navigational features of the project. I'm wondering if you can comment on the project in general and how it fit in. I guess you would say it was a less important project than the Arkansas project.

A: It was somewhat different. Basically, the Trinity River (so-called canalization project) was primarily a navigation project with very limited flood control benefits. It, of course, was strongly supported by the local interests as represented by the Trinity Basin Association in Texas.

The study was, in my opinion, a good one and a worthwhile project. It was reviewed and approved, after some revision, by the Board of Engineers for Rivers and Harbors [BERH]. It had, I believe, a good economic basis.

There were some special factors involved. A large number of bridge relocations would be required. Through some means that I don't remember exactly, without the project ever being authorized by Congress, there were several appropriations that allowed bridges then being built on new highways to be built with final clearances so that they wouldn't have to be raised if the Trinity River project became a reality.

The project was politically controversial. This controversy involved both a very strong disagreement by the railroad interests and considerable in the way of environmental questions. These had been raised late since [environmentalists] had become more active at about the time that this project study was finished. I don't remember all of the details, although the study did indicate a favorable economic ratio based on the parameters under which we had to operate.

I remember one specific issue that was a disappointment to me. I felt that one of the major types of traffic that was likely to move on the proposed waterway would be coal. Even at that time, I had the feeling that we were not going to be able to continue to use natural gas as primary fuel for power production in the area. I thought that over the years natural gas would become too expensive to be used for power and would better be used for other manufacturing processes.

Therefore, there was a good possibility that coal could be mined in the Oklahoma-Arkansas area and be barged up the Trinity. There also would be movement of lignite, which had been detected in the Trinity basin. However, we were not allowed to use these two fuel sources in our economic prediction because they weren't already moving by rail. Under the rules, we were limited in our consideration to changes in transportation mode rather than movement of new products.

I felt that the project itself was, in concept, a good one because two very strong economic communities existed on each end of the project-Houston at the Gulf and Fort Worth-Dallas area in the upper reaches. These I called traffic generators.

Such large economic communities naturally had to be tied together by transportation, and there was a fair degree of certainty that bulk materials would move between the two. For that reason I felt that traffic forecasts were probably likely to be exceeded.

The increased traffic over that predicted did develop on the Arkansas River, but for a different reason. There it was movement of materials into the Little Rock and Tulsa area, which is not as big economically as the Fort Worth-Dallas area. Also, a good deal of bauxite ore moved into Arkansas, which had not even been considered in the original forecasts.

In summary, I felt the study of the Trinity did recommend a viable project. I hasten to add, though, that whether it should ever be built was properly a political decision that had to do with whether that amount of money should be allocated to that particular type of project. But under the terms or basis for planning, it met the criteria and was a viable project.

Q: What about the railroads' objections?

A: Railroads, understandably, have always objected to the development of river navigation. This was no different.

Q: In seeing that the development would handle traffic, and perhaps more than projected, did you think this would be in addition to whatever the railroads could carry?

A: Naturally, when you have four types of transportation-air, truck, rail, and water-each one will tend to carry those things that they can handle best; and for water these are bulk commodities. Whatever bulk commodities were moving by rail would tend to move instead by water, and for those that weren't then moving at all, a viable means would develop. I felt that among the latter would eventually be coal, moving to fuel power plants that would be located along the river to supply that portion of Texas.

Q: What about the environmentalists at this point? I know they became much more intense in their opposition to the project later in the 1960s, but what was their position at the time you were there?

A: There wasn't any strong objection at the time. That came later.

Q: You were simply referring to something to come. Basically, the objections at this point were more economic.

A: We heard arguments over the rules under which the projects were formulated: arguments about the competition with the railroads; arguments about the amount of money the local interests would have to supply under the formulas allocating cost.

Q: Did you go to Washington frequently to testify about these projects?

A: I appeared annually before the congressional committees for both authorization and funding requirements for civil works projects throughout the division. I also was a member of the Board of Engineers for Rivers and Harbors and as such attended their meetings. So there were frequent trips to Washington involved in those two activities.

Q: What about the Texas City project that dealt with hurricane flood control?

A: There were major developments along the Gulf coast. Following the hurricanes of the early 1960s, plans were made for improving hurricane protection in Texas City and other areas, and for improving the Galveston sea wall as well as other projects.

Q: Was that very extensive?

A: It was in the millions of dollars. I don't remember at this point just how much, but the Galveston District did work all along the Gulf coast. Involved were levees, flood walls, and flood gates and, if memory serves me, there was at least one pumping plant, in the Chocolate Bayou area near Texas City.

Q: Do you recall outstanding civilians who worked with you when you were in Dallas?

A: We had a good group. Dick Fields was the chief of engineering and did a very fine job. As I remember, he had originally come out of the Missouri River Division, but he was already there when I arrived in Dallas I brought in a new head of construction George Andrews, from the Little Rock District. He had worked for me in the Titan II program. We had a good hydropower design section in the division office because of the high number of hydro plants we were building throughout the division. Roy Penix, who was the executive assistant in the division office, was primarily involved in dealing with political and public relations affairs. He knew the area very well, particularly Texas, Arkansas, and Oklahoma, and was extremely valuable in dealing with local interests. Joe Hoffman was legal counsel and a great asset.

Q: Would you have any comments about your district engineers during this time period?

A: Well, most of the time Colonel Charles Maynard was the district engineer in Little Rock. Colonel John Morris, later Chief of Engineers, was the district engineer in Tulsa; Colonel Frank Koisch in Fort Worth. Basically, those were the three most active districts. I dealt with all five of them, but Galveston and Albuquerque were relatively small districts. I think we had good district engineers. I used a system of field visits. I guess I was out close to half the time and tried to get to each of the district offices fairly frequently as well as to the major jobs in the field. While I was in Dallas, I was also a member of the Mississippi River Commission. This involvement was very interesting and significant to me because I had grown up near the Mississippi River. The experience at WES had also added to my detailed knowledge of the lower Mississippi River. I enjoyed being a part of that activity and association.

Eighth Army 1964-1966

Q: Your next assignment was to a staff position in Korea, correct?

A: Yes, I was assigned to Eighth Army as the deputy chief of staff of the Army, not a usual assignment for an engineer general officer. My understanding from General Wilson, when he told me about it, was that he wanted to get engineer genera1 officers in branch immaterial positions and in military assignments. With this opportunity, he had nominated me for the assignment.

Q: What would be the advantage of doing that?

A: Getting the engineer officer better known throughout the Army and overcoming some of the feeling that engineers were different,- or thought they were different.

Q: That’s the feeling the engineers had?

A: I think some people in other branches perceived that or thought they did.

Q: OK. I see what you mean.

A: I don't know all the details. I was a little surprised when the assignment came.

Q: Did you have any preferences as to where you would have liked to have gone, other than Korea, at that point?

A: I would have liked to have stayed in Dallas to finish some of the things I had going on there.

Q: You left early?

A: A little early. I came in February 1962 and left in July 1964. My reassignment was essentially eight months early. The assignment, however, was an interesting one. A major activity other than the ordinary duties was serving as the principal military member of the team negotiating a Status of Forces agreement with the Korean government. The senior negotiator and the diplomatic representative was Philip Habib,

Brig. Gen. and Mrs. Carroll H. Dunn leave Korea, January 1966.

whom you've been hearing a lot about recently. Phil and I, over a period of about one and a half years, negotiated the agreement with the Koreans. This type of assignment gave me an opportunity to meet a lot of the Koreans as well as our own people from the diplomatic community. From an engineering viewpoint, the assignment was not significant. But from the standpoint of association with the rest of the Army, it was an interesting and a valuable experience.

Q: You recognized that that was what General Wilson was trying to accomplish?

A: Oh, yes-with which, incidentally, I agreed.

Q: What about developments in Vietnam at that time? Were they being followed from where you were?

A: Yes, through intelligence reports. I was generally familiar with what was going on but not directly involved.

Q: Do you have anything more you'd like to say about that?

A: No.

Director of Construction and J-4, Military Assistance Command, Vietnam

Q: Your next major assignment came in February 1966 when you went to the Directorate of Construction in the Military Assistance Command, Vietnam [MACV]. How did you feel about getting that assignment, and what do you know about the origins of your selection?

A: Well, I wasn't very happy about it at the time, I must admit. But it was a challenge and one to be met. You referred to the background of my selection. There is a lot about this I don't know. Some of the people who do know would be General [William] Cassidy and General Clarke, and I guess General Hayes was somewhat familiar. Basically, I had heard in late 1965 that there were problems with the construction program in Vietnam.

I heard that there was interest in setting up some type of coordination and control in Vietnam, rather than having each service dealing through its chain back to Washington for construction requirements. In December of 1965, General Hayes, who was at that time director of military construction, came to Korea, and we talked briefly. I got the impression from him that, while I might have been considered for the assignment, that proposal was no longer active. It was so problematical that I said nothing to anybody about it.

Then in about mid-January, a classified back channel message came to General [Dwight] Beach, the U.S. commander in Korea, saying that I had been selected by the Secretary of Defense to go to Vietnam to be in charge of construction. Orders would be issued returning me to Washington for consultation and then for assignment to Vietnam. This came in on a Wednesday morning, and I was supposed to be in Washington the next Monday.

My wife was with me in Korea, We had anticipated a two-year tour starting in July 1964 and hoped to get back to the States in June 1966 in time to see our son graduate from West Point. So, although I had heard a few rumors, there was nothing to indicate this early change in assignment.

Maj. Gen. Carroll H. Dunn was assigned to the Military Assistance Command in Vietnam.

General Beach called me when the message arrived. Neither of us felt that there was any point in taking issue with the proposed assignment. He indicated in his response that I would be available.

My wife and I packed quickly and left that weekend for Washington. There were some major family disruptions. After all, we'd been overseas 18 months, and this represented an additional extended tour. It came as quite a shock to my wife. I think of all my Army assignments, this was the only one that ever truly shocked her, and she found it a little hard to take for a while. But, as a good soldier's wife, she did; and we came back together to the States. We got her established in an apartment in Arlington, Virginia, while I was spending about ten days in conferences at the Pentagon getting ready to go to Vietnam. I arrived on the 8th of February in Vietnam.

As far as background is concerned, I understand there was considerable discussion within the services and the Joint Chiefs of Staff. Each of the three services designated an individual for the job in response to the Secretary of Defense's requirement for what was called a "construction czar." The secretary apparently left it to the Joint Chiefs of Staff to make a selection.

As I understand it, attempts to make a selection proceeded, with each service holding out for its own nominee. Apparently, I was the only one of the nominees who was known to more than one of the services. Because of my association with the Air Force in Greenland, the ballistic missiles Titan II program, and the Southwestern Division, finally a compromise was reached, with me being designated. So that, as far as I know, is the background of how I happened to be chosen. All this went on without my being aware of it. *Time* magazine ran me down while I was on a few days' leave in Illinois and carried a story about the assignment.

Q: You referred to this position as being the "construction czar."

A: That was somebody else's term, not mine.

Q: Yes, I know. You were also characterized at one point as [Robert] McNamara's "straw boss" in Vietnam. You had indicated earlier that this position was an attempt to coordinate requirements in Vietnam rather than have each service's program go back to Washington through its own channels. You don't have to answer this right now, but I am interested in McNamara's attempts to control the situation. How personally involved was he?

A: Oh, I have impressions. Certainly there was, in my opinion, far too much control from Washington in everything that went on over there-not just in the construction program but in the detailed approval of individual air targets, [involvement in] details of deployment of troops, and many other aspects that made this war far different from any other war. Of course, this was made possible by extraordinary communication facilities.

As to the construction program, during the early days of U.S. involvement, when Americans were simply serving as advisers, each individual service developed its construction requirements and passed them back through its own chain of command. We were operating in a peacetime system with construction projects going through the appropriate services; through DOD, OMB, and to the Congress for approval, authorization, and funding; then back through a very extended chain; which obviously wouldn't work with the short-term demand of a wartime situation.

The primary difficulty in Vietnam, as requirements with the increased U. S. strength in Vietnam, was the necessity to set priorities because of the extremely limited construction capability in country. There was one construction contractor combine, then in the process of being increased in capacity. There was also a limited engineer troop construction capability as represented by a few Army engineer units and Navy seabee battalions.

Maj. Gen. Carroll Dunn, J-4 (second from left) and Brig. Gen. Mahlon Gates, Director of Construction (center) inspect a site in Vietnam, 1966.

The real problem became one of allocating the resources so those things that were of the most benefit to the Military Assistance Command in Vietnam were the ones that would get done rather than those that each individual service might request and get funded, and that then would result in a claim on the limited in-country resources. Unquestionably, there was need for someone in Vietnam to coordinate the construction activity. This revolved around the fact that there had to be established a series of priorities and a means by which controlled allocation of limited resources could be carried out. That essentially was my mission and the basis for my assignment to Vietnam and for the establishment of the construction directorate.

The directive from DOD sending me to Vietnam, in effect, delegated to me the authority to determine requirements and set priorities. This bothered General [William] Westmoreland a little, and in one of my first conversations with him, he alluded to the fact that I had been given this authority by the Secretary of Defense. My response to him was, essentially: “I know for whom I work, and obviously the priorities that are going to be set are those which you feel are the ones needed.” After that very brief conversation, there was no difficulty whatsoever.

While I had known General Westmoreland and we'd had some brief association, I had never worked directly for him and certainly did not know him well. However, we did establish a good working relationship. In the numerous discussions I had with the services about who would get priority for what, what project would be done first, and how the resources would be allocated, never once did he fail to back me up completely in the decisions that I reached. I remember vividly spending all of one day in the Da Nang area at his instruction trying to reach some settlement of the conflicting interests between the Air Force and the Marines over the development of Da Nang Air Base. The basic question was whether priority effort would be on the additional runway, which the Air Force wanted, or on parking aprons and other facilities for the Marine aircraft that the Marines wanted. Like Solomon, I "split the baby."

This was a constant problem throughout my 20 months in Vietnam. We were given a lump sum for each service in the theater with the authority to determine our own requirements. The remaining problem was allocating the construction capability rather than getting authority for a project.

The first task for me and [General] Dan Raymond, who was already there and who became the deputy director of construction, and the other people in the construction directorate, was to get a handle on what each service required. We then had to work up an integrated priority list so that the resources of the civilian contractor, working under the Department of the Navy, and the resources of the available military construction forces could be allocated properly.

Generally, Navy seabees worked in the I Corps area for the Navy and Marines, and the Army worked in the other corps areas for the Army and the Air Force. But there was some intermingling of units. On at least one occasion, Air Force construction-type detachments called "Red Horse" units, Army engineer units, and the civilian contractor were all working on the same air base that had, at that point, a very high priority to become operational.

This allocation of resources was the primary purpose of the construction directorate and, in my opinion, was absolutely essential to getting on with the program. I would say that this was probably my major contribution to activity in Vietnam. Not too long after, in July, I was appointed the J-4 of the command but continued to exercise general guidance to the construction directorate which General Raymond then took over as director of construction.

Q: In his interview, General Raymond pointed out President Johnson's decision not to call up the National Guard and Reserves, depriving the Army of its normal construction base.

A: And experience.

Q: And experience. Do you have any comments on this?

A: No question that this was a vital thing. When the first Army engineer units went over, they were quite well trained, and had capable officers and noncommissioned officers They could do what a construction battalion was supposed to do. But, because of the one-year rotation policy, after the first rotation, the command had lost all the best trained and most experienced NCOs and officers.

Maj. Gen. Carroll Dunn, J-4, Military Assistance Command, Vietnam, 1966.

As a result, a unit that arrived there, say, in the fall of 1965, and did an outstanding job for the first year, became a totally new unit when the leadership all rotated out at the same time. The lack of a call-up of the Reserves or National Guard removed the ability to feed experienced personnel into the system. With a continued rotation, every year there was, in effect, a new unit that did not have the capabilities of the unit that had been there, even though it carried the same number. It was composed totally of new personnel without the experience of the previous people.

As we began to get draftees and lost the experienced Regular Army personnel, there was a major adverse effect on the capability of troop units to execute construction. This didn't mean they didn't keep trying, but it certainly limited their effectiveness until they experienced very rapid on-the-job training simply by being forced to take on the work,

Q: This forced you to rely more on civilians, did it not?

A: Yes. It meant that we did rely heavily on the civilian contractor, So far as I know, this was the first time that the U.S. had ever used a civilian contractor in an active theater of war. There were times when the civilian contractor-the combine of Raymond International, Morrison-Knudsen, Brown and Root, and J. A. Jones-had as many as 50,000 Vietnamese working in their construction forces under the supervision of several thousand Americans.

This required the contractor to have an intensive training program for the Vietnamese equipment operators and craftsmen. However, the failure to replace experienced service construction units, after the first round, continued to be a major problem.

Q: Would you agree with General Raymond's observation that troops were better equipped for road and airfield construction, whereas civilians were better suited to build ports and utilities?

A: No question about that, both by training and equipment. We had some Army port units that did a reasonably good job on small projects, but they simply weren't capable of taking on major efforts, such as the construction of the Newport facility in the Saigon River.

Q: How about the whole question of construction standards? Wasn't that a problem, and an issue of controversy?

A: Here again, there were several problems. While our forces were in Vietnam as advisers, there was a tendency to fix things up reasonably well for the long haul and for people to be reasonably comfortable in a debilitating climate, to say the least. As the requirements increased and the number of troops increased, it was physically impossible to maintain the same standards. This made it necessary to establish new standards-but with considerable difficulty, both in changing from one standard to another and in convincing the contractor that there was a change.

There were also interservice rivalries as to requirements. For instance, the Air Force insisted that they had to have a higher degree of comfort for their pilots so that they would be rested and ready to go. The pilots tended to stay in one place so it was a little easier to justify building to a higher standard than it was for a cantonment out in the jungle when you didn't know how long the unit would occupy it.

So there were problems both in establishing and in maintaining standards, and certainly there were gross deficiencies. However, I think these standards were established fairly early in the game, and a reasonable job was done in hewing to them. Although there is no question that this was the war where we took the comforts of home to the battlefield to a much higher degree than I had ever seen in World War II or Korea, including having hot meals on the front line and ice cream and reconstituted milk and PX facilities and cold drinks. I fought 11 months in World War II and never saw a Coke or its equivalent; yet these were readily available in Vietnam.

Other things such as fresh meat and fresh vegetables and refrigerated storage in a very hot and humid climate are items you just hadn't thought about in previous wars. This standard of living added materially to the construction requirements and to the support

requirements as well. As to electricity-we never calculated electrical requirements to the degree that we did in Vietnam. Then we had to consider the question of maintenance and the need to have a post engineer force-also a new addition to active combat theater requirements. It was a different war in more ways than just jungle fighting and drug problems.

Q: What would you say about the functional component system?

A: It didn't work. Just why it didn't work is a matter of conjecture. In the first place, we had an idea but we never procured it. Second, because it hadn't been procured, it really hadn't been tested. While theoretically we could order a battalion camp, in reality we couldn't. Somebody had to put that together; the procurement and the equipment never got to Vietnam in one shipment. The shipping situation would have made it very difficult even if we had had functional components in stock. In my opinion it would have been much better to have standardized components that could be bought and shipped to Vietnam where they could have been assembled in any combination or configuration as needed. This would have made more sense than the component system as it was originally conceived. My understanding is that there's been a lot of work done on this since Vietnam. I'm not up to date on what has happened in the last few years.

Q: With the Vietnam experience in mind, perhaps.

A: I would hope so.

Q: But no one's talked to you about it?

A: Right. We did prepare some after action reports, particularly a report prepared by General Raymond. And later there were a number of studies at the JCS [Joint Chiefs of Staff] level on this subject and on control of construction in an active theater.

Q: Were you involved, say, in the JCS study?

A: I met with the people making the studies, and I critiqued some of their results. I was not deeply involved, although he [Raymond] was.

Q: What about the Seaman Board in OCE? That was in February 1968.

A: Again, I was aware of that and met with the group and provided some input. I must admit that at this point my memory is hazy on the actual results.

Q: I don't know if you'd have any further comments about procurement and its problems in relation to the job you were trying to accomplish in Vietnam.

A: Well, of course, the Corps of Engineers was not responsible for procurement. The Navy, both itself and through the contractor, was primarily responsible for procuring those things needed by the civilian contractor. Procurement for Army units was handled by the Army system through direct requisition from the U.S. Army, Vietnam. Certainly there were procurement problems throughout. Procurement of real estate, for instance, was a requirement. In the final analysis it fell on the director of construction. Yet, the procedures and people weren't there to handle it. If you look back to the original real estate agreements with the Vietnamese, they were supposed to furnish the real estate as needed by U.S. forces. However, this was [done through] small advisory detachments and was never intended to handle the situation as it developed with the massive requirements for land and facilities as the war expanded. My view is that, for the first time and unfortunately at the wrong time, we continued to try to use peacetime systems in a wartime environment, and that simply doesn't work.

Q: Why was that so?

A: I would have to say that, largely, that was Mr. McNamara's contribution to the war. We became managers and bookkeepers instead of fighting the war.

Q: And all efforts to change it didn't work?

A: Yes, there was a change, for instance, in the construction program procedures when I went there. In effect, $1 billion was appropriated with authority in the theater to decide what should be built. Immediately, however, the effort started to bring that control back to Washington to make those decisions. For instance, we still had to keep military construction funds separate from operation and maintenance funds. In previous wars, funding was for operation and maintenance, and we didn't have 15 pockets in which we had to keep various accounts. That just indicates the fiscal restraints that were imposed.

Q: Was a lot of the coordination required through the Southeast Asia Construction Office in DOD?

A: There was such a group in DOD, which Noble established. He was our contact in Washington. There also was a small group in OCE that followed up on any requirements that we might have. They tried very hard to be of assistance and to furnish help and support. As far as I know, these groups worked reasonably well, but it was a complicated system. Essentially, I can only describe it as an attempt to use peacetime bookkeeping and accounting methods in a wartime environment. In effect, it was